

Linearized FUN3D for Rapid Aeroelastic and Aeroservoelastic Design and Analysis Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



ABSTRACT

In Phase I, a prototypical FUN3D-based ZONA Euler Unsteady Solver (FunZEUS) was developed to generate the Generalized Aerodynamic Forces (GAFs) due to structural modes, control surface kinematic modes, and gust excitation using a frequency-domain linearized unstructured Euler solver based on the Navier-Stokes solution of FUN3D as the steady background flow. These GAFs can lead to a state-space equation representing the plant model for rapid aeroelastic and aeroservoelastic (ASE) design and analysis. The overall technical objective of Phase II is to develop and validate a production-ready FunZEUS that will be developed by enhancing the prototypical FunZEUS (1) to drastically improve its computational efficiency; (2) to expand its commercialization potential by interfacing with other commercial CFD codes; (3) to include the static aeroelastic effects in the GAF generation; (4) to demonstrate its applicability to complex configurations; (5) to showcase its plant model generation capability using spoilers and other control surfaces; and (6) to improve its maintainability and modularity by integrating all modules in a ZONA's database and dynamic memory management system.

ANTICIPATED BENEFITS

To NASA funded missions:

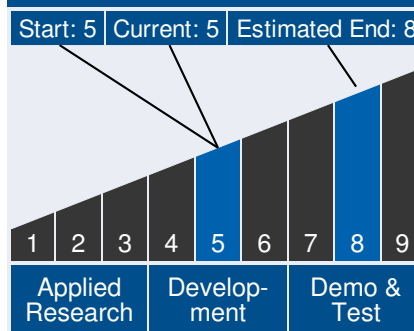
Potential NASA Commercial Applications: The proposed effort is highly relevant to NASA's on-going and future projects within NASA's fixed wing project under the Fundamental Aeronautics Program. NASA's fixed wing project involves several non-conventional design concepts such as the Truss-Braced Wing (TBW), the Blended Wing Body (BWB) and the Supersonic Business Jet (SBJ). Because of the BWB's flying-wing-type and the SBJ's slender fuselage designs, these designs are prone to the BFF (Body Freedom Flutter) problem. In addition, it is expected that the gust loads on the high aspect ratio wing of the TBW configuration will be one of the critical design loads. The

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Technology Maturity



Management Team

Program Executive:

- Joseph Grant

Principal Investigator:

- Shuchi Yang

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proposed work will offer a computational tool to the NASA designers for early exploration of technologies and design concepts that exploit the trade-off between the passive and active approaches for mitigating the potential aeroelastic problems associated with those non-conventional configurations. It thus can be seen that through the research planned to be conducted during Phase I and II of this effort, NASA's Fundamental Aeronautics Program will benefit significantly. FunZEUS developed in Phase I and II of this effort can be effectively applied to many categories of flight vehicles including X-56A MUTT, X-48B blended wing-body, joined-wings, sub/supersonic transports, morphing wing aircraft, space planes, reusable launch vehicles, and similar future flight vehicle concepts pursued by NASA, thereby largely expanding NASA's technology portfolio.

To the commercial space industry:

Potential Non-NASA Commercial Applications: The potential market for FunZEUS includes organizations involved in air vehicle design, aircraft flight test centers, airframers, aircraft analysis, commercial, business jet and military aircraft manufacturers, and organizations that maintain current air vehicles. ZONA will market FunZEUS to the aerospace industry, which includes government agencies, private industry, and universities.

Technology Areas

40% Reduction in Computational Fluid Dynamics (CFD) Error for Aeronautical Flows (TA 15.3.1.7)

Modeling, Simulation, Information Technology and Processing (TA 11)

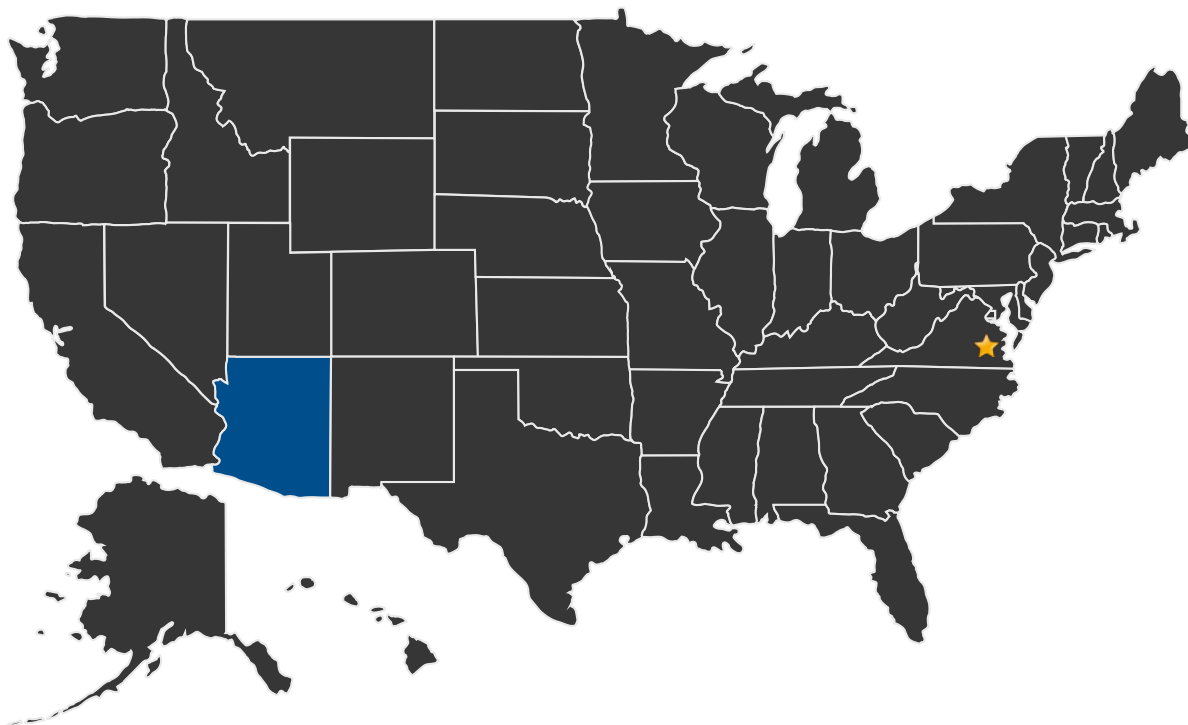
└ Science Modeling (TA 11.2.4)

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U.S. WORK LOCATIONS AND KEY PARTNERS



- U.S. States With Work ★ Lead Center:
Langley Research Center

Other Organizations Performing Work:

- ZONA Technology, Inc. (Scottsdale, AZ)

PROJECT LIBRARY

Additional Images

- Project Image
 - (This image is a .tif file. Please visit <http://techport.nasa.gov:80/file/17400> to download this image to view it.)

Presentations

- Briefing Chart
 - (<http://techport.nasa.gov:80/file/18222>)

Active Project (2015 - 2017)

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DETAILS FOR TECHNOLOGY 1

Technology Title

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